BENCHTEST

APPLE LISA

Robin Webster and Leslie Miner give their exclusive report on Lisa. Here they weigh up whether or not Apple has succeeded in its aim of providing an integrated office system for the single user.

Not all traditional computer users will be happy with the new Lisa Office System from Apple Computer.

It is an indication that something serious has happened in the industry when people get opinionated or unusually picky about the suspected shortcomings of a product.

As the following review indicates, the Lisa represents a vast improvement in the ways in which users interact and the results they achieve with conventional systems. At $10,000 Apple's new system is not low-cost, but it is powerful. While the hardware is state-of-the-art in complexity, everything else has been uniquely designed for one purpose: to simplify the interaction for the single-user. The ideal is that the machine, as one of its designers said, 'is finally cut from its roots in accounting and becomes primarily an extension of the user's ability to get results'.

With the mouse, a desktop interface, integrated software applications, and a high-resolution, multi-window display, the Lisa represents a new alternative: the office computer made as personal as possible.

In fact Apple has daringly and effectively cut across many perceived industry trends.

The feeling within Xerox, the company which did a lot of the conceptual work on window displays and icons with the Smalltalk software system and Star hardware, is reported as being, 'We blew it . . .'

The kind of response that Apple has had from its potential customers indicates an untapped demand for a Lisa-like machine. And since Apple is now ranked at 411 in the Fortune 500 (one of the youngest companies to attain the honour), it could be ideally placed to provide the right kind of computer solutions to its peer group.

In taking on John Scully as president and chief executive officer — replacing Mike Markkula, one of the co-founders — Apple has sharpened its marketing prowess, too. Scully, has already demonstrated his abilities by turning around the ailing international division of the Pepsi company, for which he was vice-president.

We had access to a Lisa for just a short time. Maybe Apple has gambled its corporate future on the roll of a dice, or maybe it has made a dramatic shift from being the company that started micro-computing with the Apple II, to the company that started it all over again with the Lisa.

SOFTWARE

This review of Lisa took place at Apple's Lisa division building located in Cupertino, California, in what had come to be known as the 'sneak room' — an area with six or so Lisas on permanent display to visiting Fortune 500 managers.

On entering the room, I placed some of my papers down on a table next to a Lisa which appeared to be switched off, and was surprised to see the screen suddenly glimmer. No keys had been pressed, the fact that I had inadvertently jostled the machine's mouse was enough to make it come to life.

Then the screen, sensing that no activity had occurred within a pre-set time, automatically dimmed. This is just a simple demonstration of Lisa's software capabilities.

The designers at Apple confessed that what they had held at the back of their minds was a 'vision' or central concept. This vision was the ideal user interface, around which a whole new machine would have to be built, possibly a whole new genre of machines. Indeed, it would probably turn out to be the very machine that they themselves would prefer to use.

The result of this work is a far better understanding (as far as Apple is concerned) of how people interact with computer systems, and notably, a Lisa-like machine. To make absolutely sure that they were on the right track, Lisa's designers arranged with the company's personnel department that all new recruits into the Lisa division should be asked to act as test subjects on the prototype machines. These recruits first indicated the level of computer experience they had, and were then let loose on a machine. Careful monitoring of their responses in specific situations gave the design team a wealth of information.

The typical user interface (that is, the operating system command line interpreter or shell) nurtures a small group of people who view computing as a challenge — a bit like bronco-busting in fact. They succeed more by conquering the command line interpreter than by using it to achieve results.

But even understanding how a conventional system functions doesn't guarantee that you will always be able to predict how it will perform. Disk errors, system lock-outs, incoherent error messages can destroy the work of even the best user. There's an ever-present fear of losing important data; a lack of reliability. This is what the Lisa team set out to conquer.

Not only is it visually clear where the Lisa user's data has come from and what's being done to it, but there is virtually no fear that any information will be 'lost' in the system.

With features like 'Undo Last Command', it can only get as bad as watching

Tom & Jerry ... after Tom is demolished in some way, you know that he'll reappear intact in the next frame.

Icons

Returning to the Lisa that automatically switched its screen on, let's examine what happens the moment a user begins to interact with the machine.

The first thing he sees is a blank screen except for a group of 'desktop' items that are at his disposal — a clock, calculator, clipboard, trash-can, and two special items called the 'ProFile' and 'Preferences' — see Figs 1 and 2.

The clock is used to set the system's time and date information; the calculator is actually represented on the Lisa screen as a full-function calculator and can be used as such; the clipboard is used for the temporary storage of information; while the trash-can is used as a hold area for unwanted files (the last item thrown into the trash-can can always be retrieved).

'ProFile', being the 5 Mbyte hard disk, is equivalent to a filing cabinet, while 'Preferences' is provided as a means of tailoring the Lisa'a capabilities to individual requirements.

These screen images are called icons. In addition other icons can be generated; for example, if you wish to put a new file onto your desktop from a floppy disk, then a floppy disk icon will appear on the screen, with the document name beneath it once everything is loaded.

Even at this stage, there are those who are critical of the fact that such icons are used to depict 'real' objects, and they are critical of the specific icons that have been chosen.

We think that this is beside the point because the icons could be modified and improved upon if necessary. The real question is: 'Are icons a better method of interacting with a system than straight keyboard entry and special function keys?' Moreover, are they useful, and specifically, are they useful to Apple's target users?

What do you do with an icon? This is where the mouse comes in.

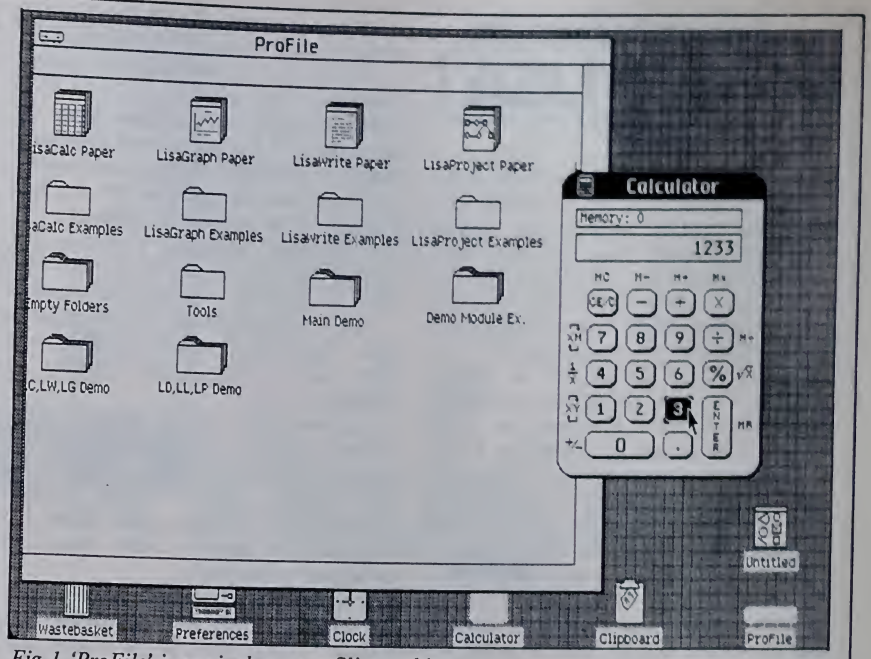


Fig 1 'ProFile' is equivalent to a filing cabinet.

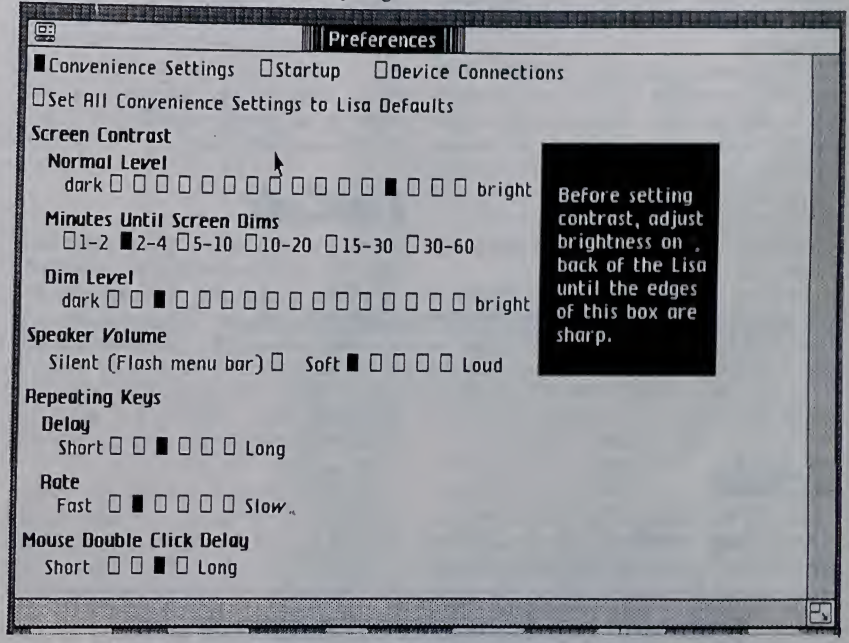


Fig 2 'Preferences' allows Lisa to be tailored to individual requirements.

The Mouse

The mouse controls the screen cursor which can be moved directly to any icon. The icon can then be selected by pressing the mouse button once. Once selected, the icon changes into a negative image (that is, from a black outline on a white background to a white outline on a black background). The user can now act upon the icon by moving the mouse/cursor to a one-line menu bar across the top of the Lisa screen.

Menus

One-line system command menus are not new. The Lisa version seems to have some of the characteristics of the UCSD p-System menu. When you change from the top-level compile and execute menu on the p-System and go into the program edit level, the menu options change in keeping with the mode. It's no use having the 'Compile' option while you are still using the screen editor, to create code. The Lisa menu does change as well, not in terms of the mode (because Lisa genuinely is a modeless system), but simply to keep track of the applications currently in use.

If you are using the spreadsheet tool you are given a menu which reads: File/Print, Edit, Type Style, Page Layout, Format, Protect, Calculate. If you simply start at your desk and wish to see what's stored on your ProFile hard disk, you select 'View' from a simpler general menu: File/Print, Edit, View, Disk. By selecting View from the menu while hold ing the mouse button down, a range of more specific options are revealed in the form of a pop-out or pull-down menu.

'View' gives you three ways in which you can display the ProFile contents: Pictorial, Alphabetical, Chronological. Keeping the mouse button depressed, you simply 'pull' the cursor down over the options and once the relevant one is backlit, let go of the button.

If 'Alphabetical' or 'Chronological' are chosen from the pull-down menu, the user is given a very recognisable directory listing which includes file names, file sizes, and the time and date they were created.

If 'Pictorial' is chosen, the user gets a first introduction to the Lisa's 'window' concept. An actual window opens up on the screen with the title ProFile. In the window are all the files on the disk represented pictorially as folders. New, unused files, seen as pads of stationery, are present too. The pads and folders are also icons and can be acted upon in the way described above.

Short-cut

For those readers who want to cut right through the menu selection route, there is

a much quicker way to achieve the same result. In order to open a folder, say, within the ProFile, or even the ProFile icon itself, clicking twice on the mouse button will also open and close icons.

Once you are in the Profile window, suppose you want to look at a particular folder entitled 'Correspondence'. You again place the cursor on the folder, select it with one click, and then either click again or go to the command menu at the top of the screen to open it. A new window appears out of the Correspondence icon, and ends up overlapping the ProFile window — much as two documents would on a real desktop.

Note that although many windows — up to 20 or so — could be open on the desktop at one time, only one window can be active. If you want to look at a window lying beneath the currently active one, you must first select it with the cursor.

The mouse can be used to select either window, to change its size, or to scroll the window contents. Double click on the Correspondence folder and it shrinks back into its icon in the ProFile window — or double click on, say, an annual report folder, and its window will be opened up on top of the Correspondence window.

Looking at the graphics orientation of the machine — the windows, the desktop metaphor and the icon images are just the beginning — you can see why the Lisa has been called 'intuitive' for office users.

Tools

Held on the ProFile in addition to the folders and stationery are a range of other icons, which the user simply knows as 'Tools'. These are the six application programs, whose integration is a key feature of the Lisa system. To the user this means that he can use any tool on almost any document, at any time, just as he would at his desk.

The six packages are:-

LisaCalc — a speadsheet program.

LisaWrite — a word processing program.

LisaDraw — a very impressive drafting/freeform drawing program that can be used in its own right, or to enhance the output from other Lisa Tools.

LisaGraph — generates all popular format graphs from LisaCalc or keyboard entered data.

LisaProject — generates a PERT-like project management schedule or flowchart, juggling tasks and resources. It is unique to Lisa.

LisaList — a personal database management program of the list processing kind.

For the user, it is possible to build a spreadsheet, generate a pie chart from all, or part, of it, immediately change the pie chart to a bar graph, add a personal memo to the graph, edit the memo, add a free-hand drawing, and then get an exact printout of the composite document.

In addition, while the Lisa user can move from one program to another with ease, he also uses — as much as possible — the same operations in each application. This reduces the amount of time that has to be devoted strictly to learning.

It's pretty clear from asking various people, that the name Lisa wasn't much more in the beginning than a project tag for Apple's personal office system. However, the company now allows the acronym to mean Local Integrated Software Architecture.

The following is a description of how we created quickly quite reasonable output illustrating some of the above programs — particularly LisaCalc, LisaGraph, LisaDraw, and LisaProject. Although these programs may not be the best in their fields, the fact that they all go to make up one integrated environment is of greater significance than a one-on-one comparison.

LisiCalc

First, we decided upon some fictitious data we could use as the raw input for a LisaCalc spreadsheet. Although this program can handle 255 rows by 255 columns (compared with Multiplan's 255 x 63), we decided on a more modestly sized matrix. The spreadsheet topic was projected sales figures for the Lisa, Apple III and the IIe over the 1983 to 1985 period.

In line with other spreadsheet systems, LisaCalc offers the user a range of cell formatting and formula creation/copying facilities. While the mouse can be used to select cells for data entry, the cursor control buttons on the numeric pad can prove just as handy. There are two nice features about this program. It shows which cells are being changed during a 'what if?' calculation by shading them grey. And if you want to format, say, a money value, the exact way it will appear is controlled by the contents of the 'Format' pull-down menu. So, if you want your dollar amounts to be preceded by a dollar sign, and show commas for thousands, you would use the mouse to select the '$1,235' option. If you wanted it to appear with cent amounts, you would choose the '$1234.56' option.

Special cell features include cell lock, circle missing values (this highlights those cells referenced by a formula but which contain no valid data), 'Undo' (can usually cancel the effects of the latest operation), and 'Revert To Previous Version' (this very useful feature can get you out of many sticky situations by dumping everything out and reloading the last saved version of a spreadsheet). Since LisaCalc can manipulate a 255 x 255 matrix, the multiple window feature — up to six horizontal or vertical splits can be made per spreadsheet — is also a necessity.

For the Lisa, we decided to show sales increasing over the three year period from $100 million, through $400 million, and reaching $600 million in 1985. Figures for the Apple III were $250 million, $350 million, and $500 million, while for the Apple IIe sales jumped up from $700 million to $1000 million and then on to $1400 million. By entering a formula for the first column of data we obtained the total income figure of $1050 million for 1983. This formula, which merely added the amount of each product's sales in 1983 together, was then copied over to the 1984 and 1985 columns.

The next step in the procedure was to select the six sales cells (the total income figures were not included) from the spreadsheet and place them on the clipboard icon for temporary storage. This can be achieved by clicking on the relevant cells, and then using the COPY function available from the Edit menu.

LisaGraph

To put the LisaCalc data into LisaGraph, we had to open up the LisaGraph icon. Once this was open, we used the 'Paste' option from the Edit menu to transfer the LisaCalc sales information from the clipboard to the graph. Almost immediately, we obtained the bar graph shown in Fig 3. By simply choosing one of the menu options the bar graph could rapidly be changed into one of the following: line, mixed bar line, pie, and scatter graphs.

Other features of LisaGraph are that data changes are replotted instantly in a 'what if?' manner; the screen size of the graph can be enlarged or compressed; graphs can be printed out in four different sizes — ¼ page, ⅓ page, ½ page, and full-page — and graph areas can be shaded in many different patterns. Also, in keeping with the concept of integration, certain functions, such as the selection of numerous typestyles and combinations of typestyles for titles, Undo Last Command and Revert to Previous Version are ever-present.

At this point, we printed our LisaCalc/LisaGraph work out on a dot matrix printer and switched to LisaProject.

LisaProject

LisaProject enables a manager visually to map the progress of a project. Individual activity, or task boxes, are created by the user and linked to form a schedule of activities leading to a goal.

For review purposes, we decided to create a simple 'Apple Team Project' chart using somewhat makeshift data

'Lisa will be considered successful if the user can accomplish something unaware of the complex underlying engineering'

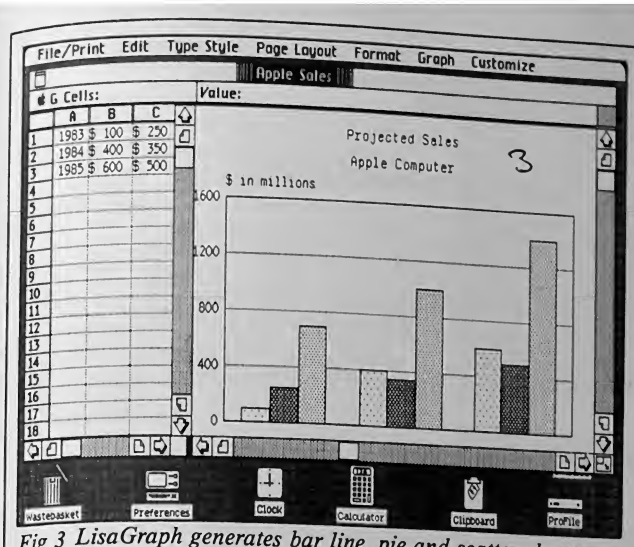


Fig 3 LisaGraph generates bar line, pie and scatter charts.

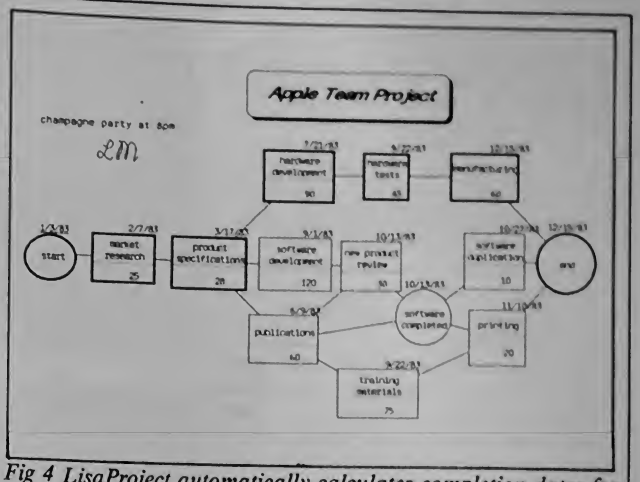


Fig 4 LisaProject automatically calculates completion dates for stages of the project and incorporates a 'what if?' facility.

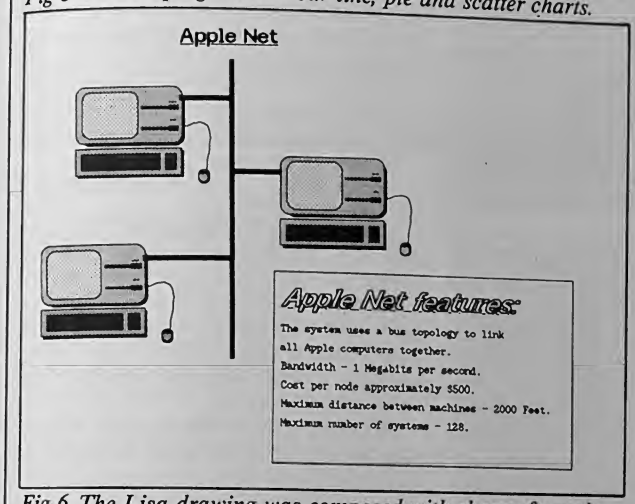


Fig 6 The Lisa drawing was composed with shapes from the palette, then shaded and cloned.

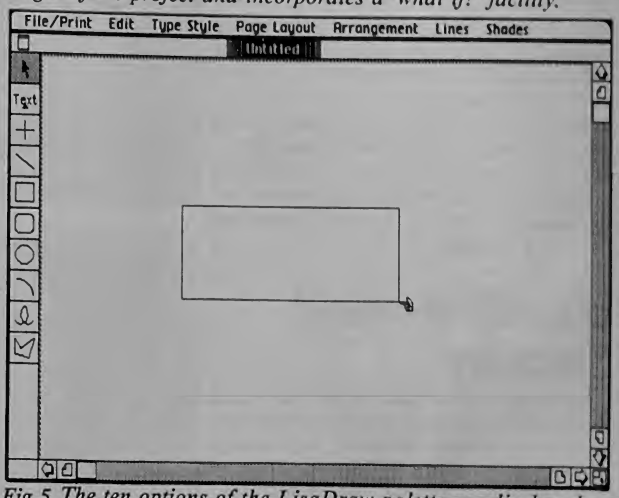


Fig 5 The ten options of the LisaDraw palette are displayed vertically on the left of the screen.

based on the Lisa project itself.

Every LisaProject chart has at least two 'milestones' (Start and End) which are displayed as circles. The specific activity boxes, such as the market research task and the connecting lines between them, are easy to draw with one movement of the mouse.

It is equally easy to add a box — like that marked 'training materials' — and to reduce the chart to a one-page display by selecting the relevant pull-down menu option from the 'Customise' command above (see Fig 4).

After each box is drawn a small cursor appears within it, signalling the user to insert text. This would be the name of the activity, its duration, and, perhaps, the particular staff member responsible for it. When we inserted the Start date within the left-most circle, LisaProject automatically calculated the completion dates for each activity and the End of project; it also highlighted the so-called Critical Path, the route along which any delays would delay the total project.

One of the major achievements of the Apple software designers is that they have brought the same 'what if?' scenario flexibility demonstrated in the LisaCalc and LisaGraph to LisaProject. Alter the data in any given activity box or boxes, and LisaProject will propagate this change through the chart.

This is not all. It is also possible for the user to visualise project tasks and resources in two other forms besides the schedule chart reproduced below.

There is a Task Chart and a Resource Chart; the latter is a kind of personnel availability calendar, looking a bit like those holiday charts used in offices. The former, while it resembles the Resource Chart, displays projects tasks in the order in which they will be performed.

LisaDraw

Now here comes the fun ... We took our LisaProject schedule and pasted it into a LisaDraw window, so enabling us to enhance the diagram for use in a presentation.

A LisaDraw palette with ten options is displayed vertically down the left of the screen (Fig 5). Besides various shapes and lines, there is a free-hand symbol and a 'Text' option. Selecting the Text option, we first added a small memo (champagne party at 8pm) and then signed initials via the freehand line draw. We then gave the title a new typestyle, decided to reposition it, and put a box around it. Further enhancements to the text were always possible since there are eleven typestyles and other possibilities such as: Bold, Outline, Shadow, Italic, Hollow, Underlined, or any practical combination of these.

While the above is an example of LisaDraw used to enhance something from another program, the next illustration was created entirely within the LisaDraw environment.

Again, the document was fictitious in nature (only the Apple Net specifications box is completely accurate). Using the Text option, the memo heading and other text was entered onto a piece of blank LisaDraw paper — no attention was paid to typestyle at this point. By selecting various primitive, or ready-made, objects from the palette (a rounded corner rectangle for the system unit, another for the screen, a right-angled rectangle for the keyboard, and so on) the Lisa drawing was put together. The mouse was a small box, but its lead, or tail, was drawn freehand (Fig 6).

The disk drive slots were drawn in under 30 seconds using lines of various thicknesses. At no time was there any fear of making a terrible mistake since all the lines and boxes could have been squashed to make them smaller, stretched to make them larger, or, if you really got into trouble, the Undo Last Command would come to the rescue.

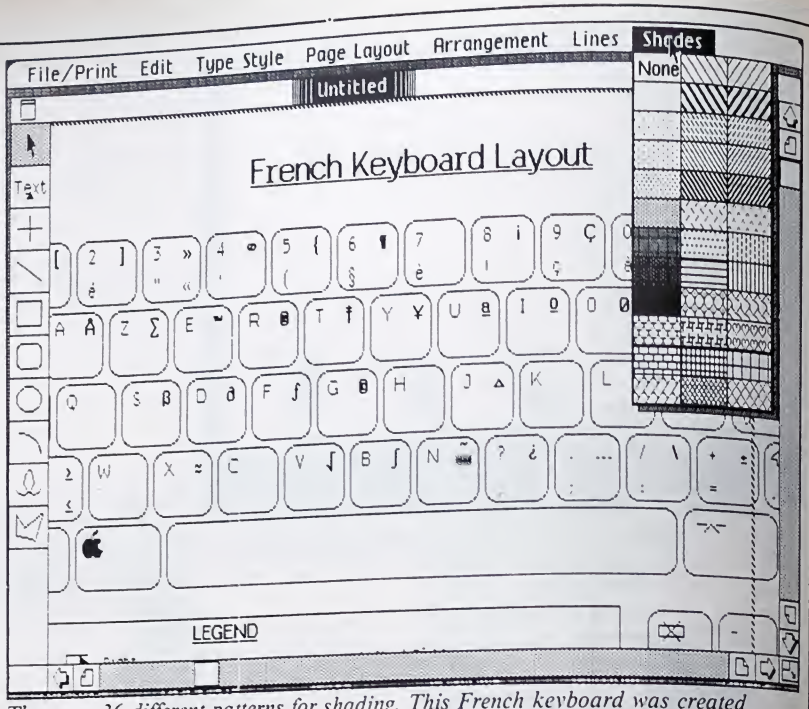
Just to show how it would look, we then selected three different shades from a total pattern selection of 36, and placed each in a different part of the Lisa drawing. Then, the original drawing was copied twice and the two LisaClones were positioned on the memo sheet.The

box around the text at the bottom right was put there by again selecting the right-angle rectangle from the palette.

The titles 'Apple Net Features', 'Apple Net', and 'Memo' were then all customised using the typestyles option. The signature, on the other hand, was a bit more difficult.

Although we were the proverbial naive users, the main memo design work took about ten minutes (it could have been done much faster, and much better). Owing to unfamiliarity with the system, the freehand signature took maybe that much time again. There is no doubt that LisaDraw is the most visually impressive piece of software that an office computer user could hope to have at his or her disposal.

As any new Lisa user will find out, the hardest thing to master is freehand drawing with a mouse. 'It's like painting with a rock' as somebody said after the experience. You do eventually get the hang of it, though.



There are 36 different patterns for shading. This French keyboard was created with the palette; freehand drawing with the mouse is the hardest to master.

LisaWrite and LisaList

This brings us to the final two Lisa application programs which we did not have time to use in detail, but which should be covered briefly.

LisaWrite, the word processing program on Lisa, is probably the best 'what you see is what you get' editor around. The combination of the mouse and keyboard allows fast selection, editing and reformatting of text. Block moves are very easy, for example, and all standard word processing features are provided. All typestyle, editing and Undo type features available with the other programs are used to their fullest in LisaWrite.

LisaList is described as being a personal database system. Essentially, it lets a user input personal types of information — phone lists, customer lists, personnel details — and then sorts them by some specific attribute or combination of attributes. There are eight data field types: text, numbers, date, time, phone number, social security number, zip code, and money.

It comes with a file-recovery system that helps rebuild damaged databases in case of system or software malfunction. This should be welcomed by users since

Dialogue boxes (error messages)

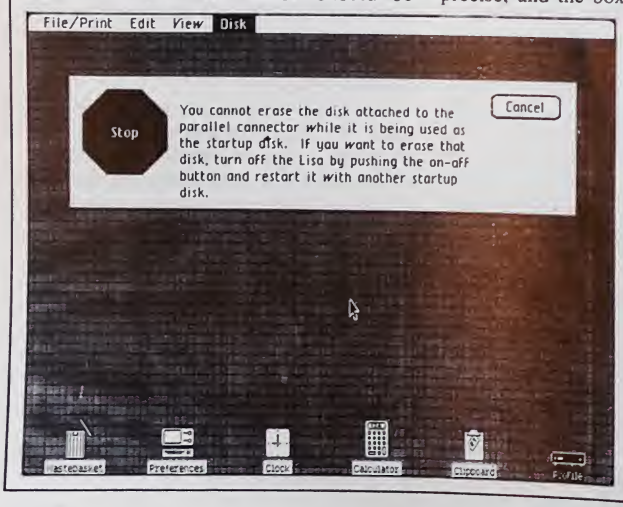
Typical error messages, as you know and hate them, can be a pain to deal with. This is either because they are of the 'XYXXE/2345.B, Diskerr. . .' type or they are crushingly blunt: 'Fatal error on system disk. . .'

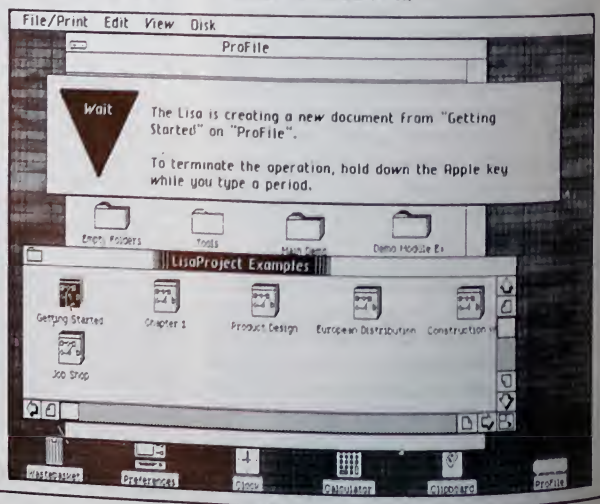
If you are lucky, the manufacturer of the machine or the software vendor will have moved one step ahead by basing error codes on a numbering system. So, if you have a disk error, the system generates a particular code number and you look in the manual to see what action should be taken.

The Lisa, we think is way ahead in this field. Instead of error messages *per se*, the Desktop Manager communicates problems and warnings to users by the means of dialogue boxes. These dialogue boxes make use of familiar road sign shapes, so they are both visually obvious and unambiguous.

The messages included in the boxes do more to calm the user than quicken the pulse. The writing style is very casual, yet precise, and the boxes are big enough to allow complete paragraphs of text, the dialogue road sign, and a menu selection area for the user. Cancelling a dialogue box cancels the command that brought it forth; selecting whatever other options may be offered will have a similarly logical effect.

Not once during the many hours we spent on the Lisa did anything catastrophic happen to data we were working on. Unlike the general type of error message, the Lisa version does not elbow aside your work just to make itself known.





LisaList can handle up to about 600,000 bytes (say, a 6000 x 100 character list) of data.

The main point about all of these integrated software programs is that they are designed to be understandable. They are not primarily designed for specialist tasks, but to make people feel comfortable rather than hesitant in their everyday office work.

The icons, windows and error messages (which appear as large road signs) are common to all programs, and are symbols of a physical world to which people can relate. The supposition is that people want to feel in total control of a concrete (rather than an abstract) manipulation of data for their concrete, real-world, projects.

As one of the designers told us, Lisa will be considered successful if the user can accomplish something without being aware of the underlying complex engineering that went into making the product reliable.

Lisa communications

Since the corporate office structure tends to be distributed both in a local and remote sense, Apple has had to devise a method of linking its Lisa equipment up into networks while at the same time keeping additional customer costs to the minimum.

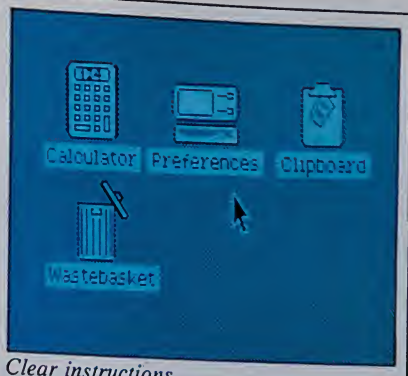
The first communications product to come out on the Lisa will be Lisa Terminal. It will be another Software Tool and, as such, will be accessible through its own individual icon and tear-off stationery pad. LisaTerminal will provide TTY, Digital Equipment VT52 and DEC VT100 terminal emulation capabilities. The first release will not be able to handle sophisticated Lisa/host computer interactions; the uploading and downloading of text created in LisaWrite or LisaCalc is likely to be the major initial component.

Sometime later this year various IBM emulation programs will be released, putting the Lisa into an entirely different kind of ball park. There will be 3270/3271 Systems Network Architecture (SNA) support, 3780 Remote Job Entry support, and 3278 terminal emulation.

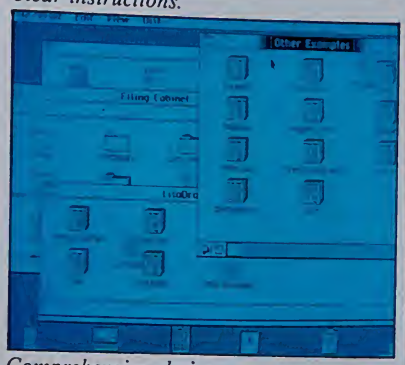
In a deal with Cullinet, formerly Cullinane, Apple will also be able to offer that company's Information Database product. This will allow Lisa users to top information stored on IBM mainframes in Cullinet's IDMS/R relational database product.

Also due for release this year is Apple Net — a low-cost, low-speed (1 Megabits per second) local area network system that can be installed at a cost of approximately $500 per user connection, or node. This will link all of Apple's products — the Apple IIe, Apple III, and Lisa — together. It features the Carrier Sense, Multiple Access/Collision Detection (CSMA/CD) transmission protocol as used on the Ethernet system.

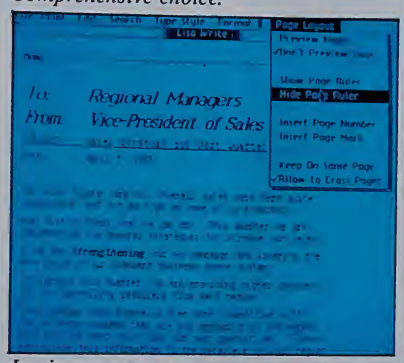
Up to 128 Apple machines can be supported on an Apple Net network which may use up to 2000 feet of coaxial cable.



Clear instructions.



Comprehensive choice.



Laying out a memo.

For those who want something more, Apple has arranged a deal with US company 3Com whereby 3Com will supply interface boxes that will tie Apple equipment into an Ethernet network (which has a 10 Megabit per second transmission capability).

The changing Lisa cursor

One nice touch about the Desktop Manager system on Lisa is that it has been programmed to take account of what might at first seem to be a trivial display aspect.

Although the main cursor is always shown as a slightly inclined arrow (↖), there are in fact six other cursor styles the user will discover. Within the matrix of a LisaCalc spreadsheet the cursor becomes a hollow 'plus' sign (⧾); in LisaWrite it becomes an I-beam(𝙸) to allow the user to carry out precise selections, such as a full point or inter-character space, during editing work; in LisaDraw it takes on the shape of very small crosshairs (+) and the grab-hand shown in *Fig 5*. While the Lisa is doing a processing task that will take more than a few seconds, it also displays an hourglass symbol, informing the user that it is busy.

The Application Developer's Toolkit

If the Lisa depends on any one thing in particular, it is the Application Developer's Toolkit (ADT) — the key method by which independent software companies will be able to create applications that make full use of the Lisa's mouse/screen/Desktop Manager.

The ADT has been under development for the last nine months and is now undergoing tests. The project was headed up by Larry Tesler, a key man in the overall Lisa project who originally worked on the Star system at Xerox. He has the honour of being one of the people who showed Apple staff members, including chairman Steve Jobs, the Star's abilities, an event which was to lead to a $50 million, three-year project that came up with Lisa.

Independent software is already being put onto the Lisa; Xenix is expected to be available this month and CP/M-68k shortly thereafter. But it will not make full use of the Lisa's Desktop Manager. The user will get some fancy graphics, but not the cut and paste type of operations.

What the ADT does is to give the software designer direct access to a framework Desktop Manager — windows can be displayed as a matter of course, but the interactions possible and the types of data they will contain is left open. Essentially, the programmer fills the empty Desktop Manager with his own data control code. The ADT is a kind of Software Workshop. Problems like, 'how do you best represent an accounts receivable package with an icon?' are still not completely answered, though.

Apple research has shown that traditionally trained software people can take six months to get up to speed in terms of writing code for the Lisa, so the ADT will obviously be of benefit here. To make sure that they are not too strained, though, the ADT project workers have actually gone as far as extending the Pascal language so that classes of objects can be more easily referred to, but the code is still recognisably Pascal. Apple's Pascal with extensions is called Clascal and will most probably be made available as a separate product, outside of the ADT, at some future date.

As an added incentive to interested software companies, Apple is also offering selected organisations significant discounts on the Lisa (with a maximum of two machines per company) plus hotline support. Response has been high and machines are being shipped out. Companies like Digital Research and Microsoft have had machines for quite a while.

Apple states definitely that it does not want to get into the operating system or software development market. 'Six years from now there will be the same six applications from Apple and hundreds developed by independents' said one manager.

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HARDWARE

Reviewing the Lisa in terms of what its hardware looks like and can do is rather misleading since there is no one part of the system which can be described as truly stand-alone. The integrated Desktop Manager software/the high-resolution screen/the mouse/the so-called Software Tools, and the CPU all work together in a highly coordinated manner. To force a distinction between 'the hardware' and 'the software' really overlooks the purpose of an integrated user environment.

At the very least, though, a description of the hardware will give you an idea of what it takes to make such a 'new wave' machine perform.

First of all, there are a couple of things to point out.

There is no such thing as a 'standard' Lisa in the conventional use of the phrase. Look at most computer manufacturers price lists and you will come across this mythical machine.

It always comes with too little main (RAM) memory; there probably isn't any disk storage included but, if there is, it will most likely be one drive; the video display will only provide the user with the simplest level of character generation; and, generally, no software will be present — except that locked in to boot ROM.

By the time you have purchased enough 'option' cards to make the thing do more or less what you want, the standard machine price has long receded into the distance and you really have made a capital investment. (Apple is a major offender here.)

This marketing approach, while comfortable for many manufacturers, tends to start customers off on the road to being something akin to system builders — they continually come across obstacles that can only be overcome by going out and buying more add-on equipment.

Such a situation is totally unsuitable for the professional/business customer, who is simply looking for methods of improving working practices. With this in mind, I'll give a quick overview of what the hardware looks like and then move on to specifics.

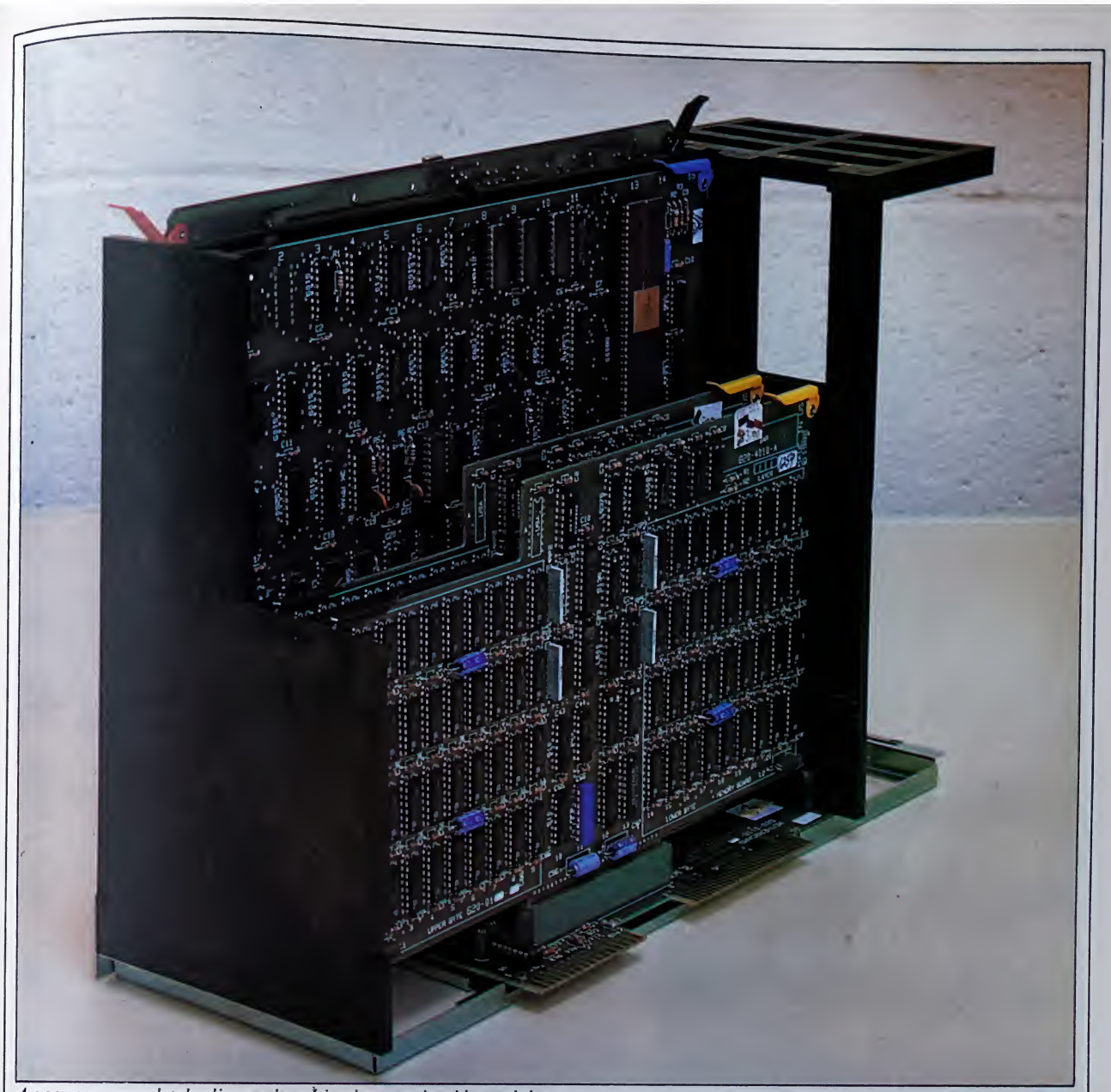
For $9995 a customer gets a complete Lisa system. This consists of the six integrated Lisa programs; the system box containing a 12in video display, the 68000 CPU, 1 Mbyte of RAM, and two of the Apple designed floppy disk drives; a 5 Mbyte ProFile hard disk; an IBM Selectric style keyboard; and, of course, the mouse.

The System Unit: Lisa's case is made of moulded plastic and, while pleasingly compact, is smaller than one might imagine from photos. The 12in video screen is placed over on the left, while the two floppy drives are immediately over to the right. A nice touch is the hollowed-out area underneath the display and drives. Since the mouse is used for a majority of file and data manipulation tasks, this is used as a storage bay for the now under-used keyboard. Tucked almost out of sight to the right of this bay is the Lisa's shut-down key. Shut-down rather than on/off switch because the Lisa is designed to ensure that all open files are closed (that is, returned to

All 76 keys are programmable but the mouse is used to issue most commands.

The system unit is compact, incorporating 12in screen on the left and storage for the keyboard underneath.

Photography by Ian Dobbie



A user can completely dismantle a Lisa into serviceable modules.

their relevant folders) before powering-down. This is a very powerful example of the interdependence between Lisa hardware and software.

One might imagine that because there is nothing but heavy disk drives and video equipment towards the front of the system unit, the Lisa might have a tendency to tip forwards. Apple designers overcame the problem by placing a couple of Sphinx-like paws on either side of the keyboard bay. Cooling vents are situated around the top, back and sides of the casing. All I/O connections are sited along the lower back.

Display

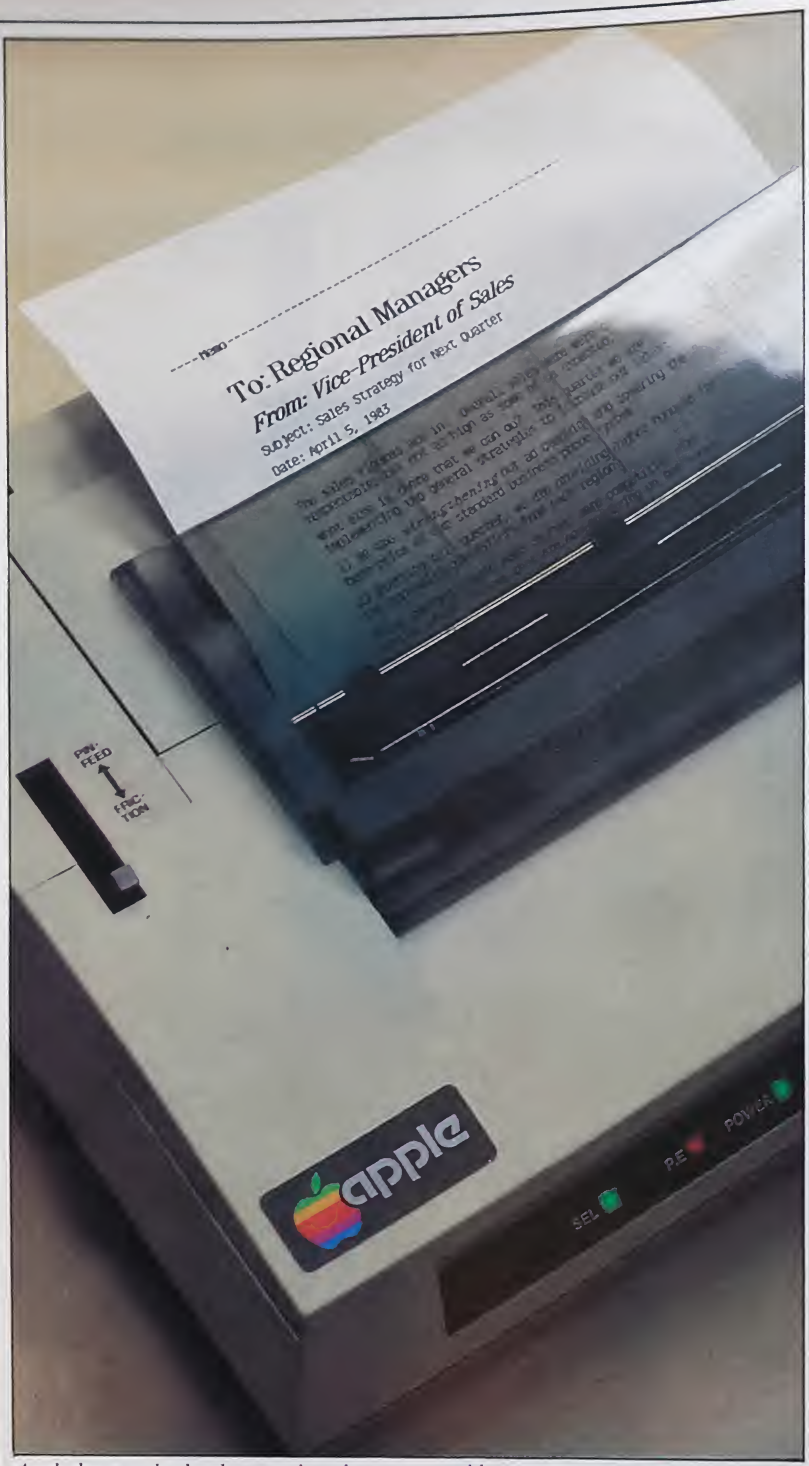
Having seen high-resolution systems such as the Three Rivers/ICL Perq and Apollo Domain, it wasn't too surprising to see a 720 x 364 bit-mapped video display which did a marvellous job of impersonating a piece of paper. The surprise is that it is now available on a commercial office product, using more or less standard chip technology, offering a set of six integrated software programs for under $10,000. Apple managed to keep the hardware costs lower than they might have been by deciding to use a 12in (half-page) screen format rather than the giant full-page (1024 x 900 pixel, or thereabouts) monitors supported by the Perq and similar devices. Also, since the screen is bit-mapped (each addressable picture element, or dot, can be represented by one or more bits in a reserved sector of memory), the smaller screen requires less attention from the CPU. The Lisa team decided not to use a graphics chip to handle the screen display (because they felt it might actually slow things down ...) so the Motorola 68000 CPU currently timeshares cycles between main processing and the video memory map processing.

Mouse

A pointing device has now replaced keyboard input as the prime method of issuing commands to a system (see box for a discussion of mouse technology). Apple has trademarked the phrase Graphics Mouse Technology, which might suggest to some that it is the first company to come up with a successful version of the device. This is not absolutely true. There have been many previous mice — some that were like enormous flywheels and just kept going in one direction. There are mice of various sizes, colours and complexity, including the three-button

'Like a jet engine, it can't turn a car into an aeroplane'

'Rolls-Royce' of mice made by a US company called Hawley. At the recent West Coast Computer Faire, a recent entrant — with just two buttons —could be seen controlling editing functions on an IBM PC. What Apple has done is to streamline the device, going for reliability and ease of use. While manipulating the palm-sized mouse is simple, its integration with the Lisa software (something which does not have to be obvious to the user) is very complex. Not just any mouse will do — end users should be



Apple has made the dot-matrix printer respectable.

Printers

It's nice to see that Apple has made the poor man's printer — the dot matrix system — respectable. To get the high-quality graphics printouts reproduced in this review, Apple had to inform the Japanese printer company, C Itoh, that its printer *could* produce the required quality. The printer, which now has a ROM chip customising it to the Lisa, 'paints' a piece of paper with dots. In low-resolution mode, the output is quite good; in high-resolution mode the output is of presentation quality. Most of the screen dumps reproduced in these examples were done in the low-resolution mode.

Reluctant to leave well alone, Apple decided that the Lisa user must have the option of a letter-quality daisy wheel printer as well — but it had to be able to do graphics. To achieve this, Apple created a completely new 130-spoke print wheel for a printer from Qume. It will reproduce all the special symbols, including foreign variations, and allow a single printout to combine various typestyles (such as standard mixed with bold and italics). Graphics output, using special dot symbol spokes, can cope with Lisa screen dumps, but they are not really as good as the dot matrix version.

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wary of advertisements and mouse manufacturers' suggestions of what their product can do. Like a jet engine, it can't turn a car into an aeroplane.

Keyboard

The Lisa keyboard is a standard, Selectric style version with 76 keys — all of them are programmable. Since the mouse has been given the main burden of issuing commands and manipulating objects and data, the keyboard does not come with row upon row of special function 'headstones'. To the left of the keyboard is the main section of the qwerty and multi-character keys (special symbols such as omega, mu, epsilon and pi, and other unusual characters are selected by the correct use of the shift key). To the right is an 18-key numeric pad which has the four left/right/up/down cursor control markings sharing key-top space with the '+', '/', '*', and ',' symbols. Although Apple decided against straight, one-punch, function keys, it is possible for the more experienced user to generate a wide range of special effect codes from the keyboard. For example, at certain stages while using LisaDraw it is possible to erase selected portions of an object by pressing the 'Apple' key (it has an Apple logo on it) and the 'Clear' key, rather than selecting the object with the mouse and then going to one of the pull-down menus to select a similar procedure. Both the keyboard and mouse are controlled by a COPS processor on the I/O board.

That's the quick overview; now we should turn our attention to more specific aspects of the Lisa hardware.

Inside

Getting into the machine is no problem since there is both a back and front cover. No special tools are needed for their removal. This design philosophy has been carried right through to the point where a user can completely dismantle a Lisa into its serviceable modules — the twin disk unit, circuit board carrying frame, power supply, and even single boards — in a matter of minutes (for the full implications of this, see 'Conclusion'). The only non-user accessible unit is the high-voltage video circuitry and monitor.

Inside the machine to the left there are three empty expansion slots. Currently, the indication is that Apple will not rush to fill these, rather, it will encourage independent hardware vendors to offer their products. From the hardware engineers' point of view, the expansion slots provide a very simple means of attaching all sorts of devices to the Lisa. Simple, because the slots provide add-on cards direct memory access (DMA) instead of routing signals via the CPU.

Apple's only current exception to the 'no add-on cards' rule is a parallel interface board ($195) which is needed to help manage the generation of high-quality out put on a specially redesigned dot matrix printer from the Japanese company C Itoh. While this does take up one of the three expansion slots, Apple is working on a serial version of the matrix printer which will use one of the two RS232 ports on the Lisa.

All circuits boards, expansion slots, and even the I/O connections, are held in a specially designed slip-out carriage. This board holder is a novel method of securely retaining a lot of hardware in its place, while at the same time making access extremely easy.

Since the holder is only connected to the main system box by gold-plated edge connectors, simply tugging it towards you makes it glide out smoothly. If you ever ripped yourself to pieces trying to remove a board from an old terminal (the soldered side was usually loaded with razor-sharp objects right where you had to grip it), or ever found out too late that you had put the CPU board into the wrong slot, you'll appreciate what Apple has done for the user in this area. Every board has been supplied with colour-coded grips and unique edge connector layouts so that it is impossible to damage yourself or a board.

Although I mentioned earlier that the Lisa has a shutdown button, the machine is never completely off. A battery pack located on the I/O board maintains the system in a kind of slumber, waiting for some one to come along and press a key to reactivate it. This is rather like the temporary display blanking that some calculators use to conserve on energy while retaining numbers to be eventually used in a calculation.

Motorola 68000

Having conceived a complex software environment for the user, Apple designers were aware, even at the theory stage, that a fairly powerful processor would be required to cope with the kind of activity that would be required of the Lisa.

There are a couple of reasons why the Motorola 68000 was chosen.

This 32/16-bit chip (almost all its internal CPU registers are 32-bit while the external data paths, along which data is fetched and sent back out, have a 16-bit transmission capacity) has been the choice of many specialist multi-user system builders for the last few years. Only recently has it been receiving the kind of general attention it warrants.

Sage Computer Technology chose the chip as a powerplant for the Sage II. It is also the featured chip in the Corvus Concept, the Tandy TRS-80 Model 16, the Fortune 32:16, the Wicat and the somewhat intriguing IBM 9000 scientific system.

Apple adopted the 68000 because it was the best advanced chip available in sufficient quantities at the time the Lisa project began (1979).

Early samples were used for prototyping, but it was not until Motorola could give assurances that 5 Mhz versions would be available in production quantities that Apple made the commitment.

While offering the power of a true 16-bit chip, assisted by its 32-bit internal structure, the 68000 couldn't give Apple's software designers one much-needed break. Sitting inside the Lisa is about 2.5 Mbytes of object code which makes up the Desktop Manager system. Add to this the code which makes up the various Software Tools — LisaCalc, LisaWrite, LisaDraw, LisaGraph, LisaList, LisaProject range in size from 200k to 400k — and you have an enormous problem shifting that number of bytes around in a reasonably professional manner.

> 'Apple designers were aware, even at the theory stage, that a fairly powerful processor would be required'

Memory management facilities developed by Apple for the 68000 make the software handling task much simpler because it offers the ability to relocate blocks of code in memory — virtual memory in fact. To quote the Lisa specification sheet, the memory management system on the machine allows for the 'segmentation (of memory) into 128 variable-length blocks dynamically controlled by memory map table'. That's 16 Mbytes of virtual memory.

In addition to having an Apple-added virtual memory facility, the Lisa can do multi-tasking and lock out bad memory cells. While one job is being printed, a user can go ahead and use the LisaCalc program, or whatever. If memory errors occur, the system will not halt all processing until repairs take place. Rather, the parity checking system will steer all operations away from the faulty sector(s) and so allow Lisa to continue processing.

Diagnostics

Keeping with recent industry trends, the Lisa comes with built-in diagnostics that go into action when the machine is fully powered up. The user is given a set of visual symbols denoting which piece of the system Lisa is currently testing, and, if everything goes well, tick-marks appear in each symbol field. There is a full 64k of diagnostic code held in ROM (remember, that's the size of many standard personal computer main memories) and if the display is not working, the Lisa emits specific groups of tones from its internal speaker that can be understood easily by a user.

Noise

Noise can be a problem in an office environment and, as many personal computer users would testify, their machines are not always as quiet as they might be.

The biggest traditional culprits in this area are the cooling fan and the disk drives. This first problem was overcome in the Lisa by devising a passive, or convection, cooling system. Since warm air rises, the designers arranged for all the main circuit boards to be held upright in a special carrier frame. As the boards begin to generate heat, it is taken in by the surrounding air which then escapes through vents positioned at the top, back and sides of the casing.

It seems to work well as there were no signs of internal overheating during the review sessions. Nor did it get perceptibly warmer around the machines.

The second potential source of noise, the disk drives, never had to be dealt with. The 5 Mbyte ProFile disk (which was originally built for the reasonably successful Apple III) has always operated with a minimum decibel output. Most of the Lisas have ProFile placed conveniently out of the way on the main system unit. Although this is not a prerequisite, it certainly reduces space requirements on a desk.

Disks

Most floppy disk drives are worth just a quick look to see if all the bits and pieces are there and how much storage they provide. If you're really lucky, you might even find out that the machine you're thinking of buying can read disks of different formats.

In the case of the Lisa's drives, it's worth devoting more time, since by standards, they are excellent.

While the ProFile gives 5 Mbytes of storage — a common enough amount by today's standards if you look at computers like the IBM XT, ACT Sirius 1, and Wang Personal Computer which come with, or can be configured to have, 10 Mbyte drives — the two floppy drives cope with 860k formatted (1.4 Mbytes unformatted) storage each. Therefore the total removable storage is over 1.7 Mbytes . . .

Here's how Apple managed to create such a dense packing of data on a 5¼in disk.

Traditional double-sided disks rotate at about 300rpm and store somewhere in the region of 200k to 400k — a notable exception to the rule being the 600k+ drives of the Sirius 1. The Sirius 1 uses multi-speed drives that can spin standard disks at up to 350rpm when necessary.

Apple decided that rather than stay with commercially available drives, which didn't offer the kind of functionality or reliability the Lisa demanded, a totally new unit using a totally new 5¼in disk would have to be built.

A Synertek 6504, which is not too far off from the 6502 chip that has kept the

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Apple II running and running, is dedicated to each of the Lisa drives, acting as smart interfaces with the main system. One of the jobs the 6504 has is to vary the speed of the drive in keeping with the position of the track it is reading or writing so that data is laid down in a regular density of 10,000 bits/65.4 tracks per inch.

Since ordinary drives rotate at one speed at all times, regardless of where the recording head is located, data is more densely packed on the tracks closer to the disk centre (where the disk surface is travelling more slowly than at the outer edge) and relatively sparsely elsewhere.

The internal set-up of the Lisa drive is also very different from other double-sided units. Rather than having both heads positioned so that the disk media is pinched between them, increasing wear, the Apple drives have offset heads and special opposing pressure pads that access the disk surface through two cut-outs in the disk jacket. In the early development days of the Lisa project, having such unique disks was a definite advantage because even if a prototype machine had been stolen, illegally borrowed, or whatever, the fact that virtually all disks were kept safely locked up meant that no harm could be done.

Now that the Lisa is ready for the market, one wonders what kind of production arrangements Apple has made. Certainly, at the time of this review, no one at the company could give me any details on pricing, etc.

Security

We're not yet finished with the disks, because there are two remaining features that must be covered — data integrity and data protection by means of automatic disk retention.

Files stored on a disk are located by means of a directory set up on a particular grouping of tracks. If this map-like data should be corrupted in some way — either by software or system failure — it is not always possible to recover all the lost data held on the disk. The Lisa drives, however, are made to lay down a special block of 24 bytes per each 512 byte disk sector. Contained in these 24 bytes is a description of which file the block belongs to and where in the file it should appear. Further pointers to disk space allocation are also held within files themselves and in the main directory. Inevitably, some information will be lost, but it will have to be precipitated by something fairly catastrophic.

If you've read something about the Lisa you will already know that its disk drives do not have the conventional flip-down doors which can be opened at any time, regardless of what is going on. Instead, the drives have an automatic lock and load feature made possible by automatic 'disk present'

The Mouse

The difference between the traditional keyboard and a mouse is essentially the difference between sending morse code signals down a wire or using a telephone. While the telegraph and telephone achieve more or less the same result, the speed of interaction, and what might be called the 'fluidity' of communication, are just not comparable.

People first interacted with computers via teletypewriters — electromechanical devices that generated printed text either from an attached keyboard or in response to computer output. So it is not unnatural that they should have become used to dealing with line by line printouts that were issued in true typewriter fashion. If they wanted to leave blank lines on a printout they had to hit the 'line feed' key the required number of times. If they wanted to write something only at the end of a line, they might use the space bar, or tab key, to move the print-head over to the right.

Things remained pretty much the same even when paper was replaced by cathode ray tubes (CRTs, VDUs, or whatever you like to call them) as the prime method of displaying user input and computer output. The print head was replaced by a flashing or solid cursor (an underline, or solid square), but the user could still only move around the screen in discrete up/down/left/right movements. Cursor addressing, a facility made more accessible by the higher-level languages, was used but this was handled strictly at the program level.

The mouse unlocks the cursor from its straight-line existence and instead gives the user total control of its positioning. Connected to a computer by a thin cable (the tail), the mouse consists of a palm-sized package of electronics and mechanical/electrical/optical equipment which converts analog movements (drawing of a circle, for example) into digital signals. These digital signals are than acted upon by the relevant onboard processor, and a circle appears on the display.

Apple's mouse is probably one of the simplest to use. Where others come with up to three control buttons, Apple's has only one for all actions. The multi-button mice have a sense of function keys about them — you push this one to do action number one, then you push the other to do action number two. This is because they are generally used with far simpler software than that supplied with the Lisa. The Apple mouse demands only that a user follow the simple rule: if you press the button twice to open one icon, you do exactly the same for another icon, independent of the program or stage you are at; if you want to select something from the pull-down menus you always click the button once after the required option is backlit.

Of course, there are times when the mouse becomes clumsy or redundant and that's why there are still cursor control and special escape keys/key sequences on the Lisa keyboard.

Lisa's engineers are sometimes criticised for selecting the mouse rather than other quick data input devices — notably the trackball, touch-screen and light-pen.

They point out that the trackball (which can be thought of as an upside-down mouse) requires two quite distinct operations. First you use your fingers to roll the cursor control ball as is necessary, then you have to reach over and press a command button. The mouse user can both move the device and press a button at the same time, so maintaining smooth movements.

The touch-screen and light-pen both have the limitation that the user must first identify the location that has to be touched, and then a physical movement has to be made to identify or select an object. Delay and arm fatigue can be a problem here. Also, touch screens do get fingermarked and light-pens have a limited resolution. If there are two option boxes placed very close together on the screen the pen might only be able to straddle them, and not deal with them as two distinct objects.

The Lisa mouse is simply built. All the electronics are held on one small internal circuit board, and there are only a few moving parts. One is the teflon-coated metal ball which partially protrudes out of the bottom of the mouse casing. There are also the rollers, placed at right angles to each other, which translate mouse movements into x/y coordinates. The rollers touch the teflon-coated ball and move in accordance with it. Depending upon the skill of the user, such mouse-controlled movements can be made highly accurate — it doesn't take much time to be able to pick out a specific pixel with the cursor. Since the office environment poses a lot of potential hazards to mouse mechanisms — cigarette ash, abrasive paper fibres from lots of paper shuffling, and even the left-over debris from eat-in lunches abound — Apple has made its product user-serviceable. By unscrewing a black plastic retaining ring, the teflon ball can be tipped out and both it, and the mouse insides, given a clean-up.

During this review, we found the mouse to be a truly natural method of interaction. The only problems were freehand drawing in the LisaDraw program and the fact that you had to keep your desktop neat — something managers may find difficult.

A replacement for the keyboard?

sensors. If you want the disks back for some reason, you cannot just yank them out. To the right of each drive there is a disk request button which signals to the CPU that you want to remove a disk.

Before anything else is done, the Desktop Manager checks to see what files are open and then sets about closing them. Once everything is cleared from the desktop the disks are automatically ejected.

Having visited an office shortly after somebody lost 20 pages of WordStar text by removing the disks and resetting the system without doing the hallowed ^KD, I think there are many people out there who would consider the wait a reasonable price to pay as an insurance against going into a sudden state of speechless shock at losing an afternoon's hard work. And, anyway, what are you going to do with the disk if all your work hasn't been saved on it?

Documentation

During the review, provisional documentation only was available for use — the exception being a proof copy of the LisaDraw user's manual. The provisional material was more than adequate, but the LisaDraw manual — in fact it was more like a commercially published book — was probably the best.

It was properly typeset on good quality paper and there were many photographs and high quality prints of the Lisa and its display to provide visual backup. Contents and page number information was also included. If all the documentation is of this quality, there won't be many complaints.

In addition to the manuals, Apple has written LisaGuide, an interactive guide on using the Lisa. It is quite a major achievement in itself since it avoids being condescending where it easily could be so. It makes full use of the display's high-resolution and the mouse, so helping novices quickly through the acclimatisation process.

Service

Apple is offering various levels of service for the Lisa.

The ordinary user will be able to take advantage of the Apple Care Carry-In service whereby the machine is handed to a local dealer who will swop out the faulty part and replace it. Dealers will carry stocks to cover most component failures.

Bigger users can take out a contract with Apple whereby RCA will send a service person to the site.

At the top end, Apple will provide in-house training so that Fortune 500 users can do all but the most major repairs themselves.

There is also a hot-line direct support service permanently available by telephone.

Discounts

Against the high single unit price of the Lisa, Apple is setting a series of discounts for customers prepared to sign 12-month contracts.

If you are prepared to show a definite interest in buying a few machines over the next 12 months then you can gain a 10 per cent reduction in the cost price per machine.

A customer which will commit to buying 275-549 units in the coming year can obtain 15 per cent discount. For 550-999 units the discount increases to 18 per cent.

At the top end, 1000 definite orders will yield a 20 per cent discount rising to 28 per cent for even greater volumes. International companies can gain these price reductions on a worldwide basis.

Prices

Lisa:	$9995 (UK price around £8500) — includes main unit, 1 Mbyte of RAM, display, system/applications software, keyboard, mouse, and 5 Mbyte ProFile hard disk unit.
Dot Matrix Printer:	$695
Daisy-wheel printer:	$2100
Languages:	
Basic Plus:	$395
Pascal:	$595
Cobol:	$795

Conclusions

Really to get an idea of what has happened, you mustn't compare the Lisa directly with other machines such as the IBM PC, the DEC Professional, or the Sirius 1. If you do the sums, they actually show that the Lisa is competitive in terms of price, and totally unapproachable in terms of integration (once all storage, software and necessary add-on boards have been accounted for).

Certainly, the recent announcement that Digital Research would be aiding and abetting Visicorp in implementing the mouse-controlled, window-oriented VisiOn product in the CP/M environment is significant. So too, is the fact that IBM, DEC and Texas Instruments have all said they will support the VisiOn package on their relative machines.

Microsoft, with its MultiTool word processing system, has also adopted the mouse as a viable alternative to laborious key-board commands. The product has windows, and is modelled after the company's Multiplan spreadsheet program.

Both packages will be moderately priced — a few hundred dollars each — and this will obviously meet a vast number of users' needs. But consider that we're talking about different leagues here.

VisiOn and other similar products waiting in the wings, run on a range of manufacturers' machines that have not been optimally designed for such products. The keyboards are still the unhappy mixture of qwerty and dp functions; the mice are add-ons rather than a fundamental part of the computer's design philosophy; reliability in the software may not be mirrored by reliability in the hardware.

In summary, the hardware/software division is still maintained. Obviously, events in the next six months are going to provide some answers to such thoughts — but our feeling is that there is room in the market for both approaches.

Technical Specifications

CPU	32/16-bit Motorola 68000 running at 5MHz.
Other Processors:	SCC chip in keyboard and NatSemi COPS on I/O board to handle keyboard and mouse.
RAM:	Presently 2 x 512k boards or the option of 2 x 1 Mbyte boards — to be introduced shortly — that will fit in the same slots.
Diagnostic ROM:	64k start-up diagnostic code checks out disks, memory, etc. Capable of generating audio backup if the display fails.
Display:	Crisp, black on white background, video generation. 12 inch diagonal, 720 x 364 pixels, bit-mapped in upper area of RAM memory.
Keyboard:	IBM Selectric style, 76 keys (no straight function keys) including numeric pad.
Mouse:	One button, see and point operation. Accurate for cursor positioning down to individual pixels.
Floppy disk storage:	Two 860k, 5¼in, floppy drives integral to system unit. Unique twin access windows in disk envelope because of offset drive heads.
Hard disk storage:	1 x 5 Mbyte ProFile hard disk, as orginally designed for the Apple III. More than one can be connected.
I/O ports:	Two RS232 ports, one parallel interface port.
Expansion slots:	Three empty slots are available.
System Software:	Desktop Manager operating environment, and six Lisa specific application programs: LisaCalc, LisaList, LisaWrite, LisaProject, LisaDraw, and LisaGraph. Others, including LisaTerminal, will follow.
Languages:	Basic Plus, Cobol, Pascal. Others are under development, incuding the Smalltalk language/environment.
Printers:	Dot Matrix graphic printer (parallel) and letter quality daisy wheel (serial) printers.